Surf Zone Obstacle Clearing by Use of Smart Weapons

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LONG-TERM GOAL

The use of "smart weapons" as an effective means of destroying targets, while minimizing the danger to military personnel was demonstrated in Operation Desert Storm. Due to the success of these weapons systems the Navy and Marine Corps has started examining other operational areas where they could be effective. One area that could benefit from these systems is the clearing of beach sites for amphibious landings. Currently there are no systems that can clear the landing sites effectively and without putting military personnel at risk.

OBJECTIVES

The objective of the study is to examine the feasibility of using smart weapons against Surf Zone (SZ) obstacles. This objective is accomplished by determining applicable systems, identifying advantages and disadvantages for each system, and determining the variables, which effect the system performance. These variables include target reflectance, laser detector sensitivity, and the circular error probability.

APPROACH

The approach to the study is to first perform a literature search on "smart weapons". The information obtained in the search provides the foundation for the assessment of the smart weapons, and identifies the major variables responsible for precise targeting of the smart weapon. The next step in the study is to determine the important variables for SZ obstacles and develop a relationship between the variables for the smart weapon and the SZ obstacles. The relationship is used to determine the limitations of using smart weapons against SZ obstacles.

WORK COMPLETED

The completed work is fully documented in the classified Report CSS/TR-98/27. The classified report examines the feasibility of using smart weapons against SZ obstacles. In the interest of consistent comparisons, four assumptions are made:

1. Only the current arsenal of U.S. weapons is examined.
2. The SZ obstacles considered are not be covered by water.
3. A direct hit on the obstacles is required.
4. No troops in the area to aid in targeting.

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The report provides a brief explanation of the different categories of smart weapons. With this basic understanding, the report addresses the four major variables:

- Guidance of the weapon, which, depending on the class of weapon, can be guided either by aircrew control or laser designators.
- Sensitivity of the laser detector on the weapon.
- Circular Error Probability (CEP), which applies to all weapon systems.
- Reflectance of the designated target.

A conclusion is reached based on the relationship of the variables.

RESULTS

The conclusion of this report is that a smart weapon can be used against surf zone obstacles with two restrictions. The first restriction is the weapon must have a CEP of roughly three feet for a direct hit, due to the small size of some of the surf zone obstacles. As seen from this report, the only way to achieve this is by using a laser designator for the terminal phase of the mission. As an example the GBU-29/30 JDAM Bomb, which uses GPS and an inertial navigation unit has a CEP of approximately 10 feet. The second restriction is that the laser detector in the weapon must be sensitive enough to account for signal losses due to the atmosphere and the reflectance of the targets. Reflectance values of typical surf zone obstacles range from 30% to 95%.

An example of such a smart weapon that meets these two restrictions is the Hellfire missile. The CEP of the Hellfire missile is classified, however, it meets the three feet requirement. The laser detector on the Hellfire missile is also more sensitive than other systems. The Hellfire missile is compared to the Laser Guided Bomb using the same laser range finder against the same target reflectance. The Hellfire missile can detect a signal hitting a surface with 2% reflectance at its maximum deployable distance. The Laser Guided Bomb can not detect signal hitting a surface with 89% reflectance at its maximum deployable distance. Even though atmospheric conditions are addressed in this report, it is apparent that greater detector sensitivity will also compensate for some atmospheric attenuation.

Recommend further studies of target reflectance of standard obstacles. The values used in the report were for flat samples. The geometry and the reflectance values get more complicated when the material is assembled into the desired shape (hedgehog, tetrahedron, etc.). Depending on the shape, there could be more specular reflection, more diffuse reflection, or a combination of both. Another factor that affects the reflectance is the condition of the material. After time, paint fades and metal starts to rust. To get more realistic reflectance values, it is recommended to either computer model or physically measure the reflectance of the obstacles in their final form and at various ages.

Recommend further studies into extracting the target signal from the background signal. The report assumes that the laser designator spot only illuminates the target. This will not be the case for smaller targets. Depending on the distance to the target, the laser beam size could cover the desired target and some background. If the background has a higher reflectance than the target, the weapon will home in on the background. This is not a new problem, however, using smart weapons against small obstacles is a new mission area for the smart weapons. It is recommended that an investigation be performed to determine what is currently being done by the Department of Defense to solve this problem. This

investigation should also examine the modifications that need to be done for the surf zone obstacle mission.

Recommend further studies into multiple targeting from one source. The guided-munition is a "one-on-one" weapon. From an operational perspective, this is a major limitation. This limitation requires that there have to be many laser designator operators in the surf zone area illuminating the targets, which results in exposing a large number of personnel to enemy fire. The alternative is to have one laser designator that illuminates a target until the target is destroyed, at which time the designator switches to another target. This alternative eliminates the benefit of a synchronous, single impact strike due to the time required for designating one target at a time. It is recommended that an investigation be performed to determine other methods of illuminating multiple targets from a single laser designator source. One possible method is to attach a small optical assembly on the front of the current laser designators that will split and project the beam in different directions.

IMPACT/APPLICATIONS

Due to the small size of the explosive in the smart weapon warhead, it is necessary for the smart weapon to directly hit the surf zone obstacle. This study shows that it is possible to use smart weapons against surf zone obstacles. However, using highly complex and expensive systems "one-on-one" against simple and cheap obstacles is not cost effective. An alternative is to use larger munitions that would destroy multiple obstacles or displace them from the operational area. The larger munitions would be less sensitive to the targeting accuracy of the laser targeting, since they would be targeted at a point in the obstacle array and not at individual obstacles.

TRANSITION

None this fiscal year.

RELATED PROJECTS

The Standoff Delivery of Bombs Task makes use of smart bombs and laser designators. This task is also interested in the target reflectance of standard obstacles.

REFERENCE

B. L. Price, 1998: "Surf Zone Obstacle Clearing By Use of Smart Weapons (U)," CSS/TR-98/27, September, NSWCCSS, Panama City, FL (SECRET)

PUBLICATIONS

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